A Comparative Fem Structural Analysis by Applying Displacement to the Hero Honda Passion Bike Shock Absorber using Composite E Glass Epoxy Material.

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***Abstract*— Whenever I drive bike for more than two hours or 40 km/day , Immediately I felt back pain because of lower capacity to absorb the shock of my bike so it pass the shocks from road Surface to me and I Feel the shocks. We have not all roads are well finished .Recently used shock absorbers are not comfortable for every condition. There is one approach to increase shocks absorbing capacity of suspension by utilizing E glass Epoxy material instead of spring steel material in helical compression spring of hero Honda passion bike shock absorber .In my Earlier research paper analysis of shock absorber done by applying Force and measured displacement and stress and strain level produced in both the conventional and modified shock absorber. In this research paper Shock absorber FEM analyses is done by applying predefine displacement and measured transmitted force in both the analytical model .E glass Epoxy material shock absorber which produce or transmit less force at other end are comfortable shock absorber .Shock absorber major affect for those which perform their Business or Duties for more than two hours driving on bike may felt Pain at the end of day.**

Keywords*— Shock absorber , FEM , CREO, Stress, E Glass Epoxy , Composite, Helical compression Spring Introduction

INTRODUCTION:

Global requirement of damper is above 1 billion per annum .european country required five million shock absorber annually for new one and one million for replacement. Shock absorbers are most comfortable when they not noticed. They require trouble free. For bad road driving smoothly is only possible with effective suspension. The shock absorber is drafted by using the modeling creo software. In modeling the time is spent in drawing the all component and assemble the all the parts modeling is imported to ansys for the fem analysis work. The ansys software is used for analyzing the shock absorber by varying the displacement applied on it and the results are observed. Generally displacement is provided because in road when vehicle pass on the bump. Bump will provide positive displacement to the vehicle and pot hole which provide .

LITERATURE REVIEW:

The shockabsorber is one of the main component whih provide the comfort level by absorbing the road shock and prevent it passing the occupant .this will provide supreme comfort level . in the shock absorber spring and damper play major important role , spring is absorb the shock and damper damp the spring vibration .hence the spring is very important in the shock absorber .

The introduction of composite materil is made possible to increase comfort level and reduce the weight without reducing load carrying capacity. several papers devoted to the application of the composite material for the shockabsorber helical compression spring.

Marnish Modi [1]

Stress developed in the modified E glass Epoxy design are comparatively lower than spring steel conventional model and all the stress developed are lower than yield strength . E glass Epoxy composite spring absorbs more shock so it will provide more comfort to the vehicle ride than conventional shock absorber. it will reduce the acceleration which is essential for improve drive comfort.

Claude Bathias[2]

in the Gigacycle Fatigue in Mechanical Practice, published the property of spring steel . Spring Steel is the best material for helical compression spring . its revolutionary material invented by Japanese Researchers, Spring steel having Excellent Property to with stand the Fatigue load. Spring steel having very high ultimate tensile strength .

Table 1 Property of spring steel material

1	UTS (MPa)	1800
2	E (Gpa)	210
3	Density(Kg/m^3)	7850
4	G (KN/mm^2)	81.5
5	Poision ratio	0.3

Satbeer Singh Bhatia [3]

studied the application of composite material for Analysis of the Design of Helical Compression Spring to Study the behavior of Steel and Composites used as spring materials. Introduction of E Glass Epoxy material and carbon Epoxy will

reduce the weight without losing load carrying capacity. Composite material having high elastic strain energy storage capacity and high strength to weight ratio compared to spring steel. Stress induced is also lower than conventional spring steel material. Deflection is higher than spring steel material hence its load absorbing capacity higher which providing comfort.

Table 2: E glass Epoxy Orthotropic Property

1	Tensile Modulus in x direction (Mpa)	4.3*10^4
2	Tensile Modulus in y & Zdirection (Mpa)	6.5 *10^3
3	Ultimate tensile Strength (MPa)	900
4	Compresive Strength (Mpa)	450
5	Shear Modulus in xy direction (Mpa)	4500
6	Shear Modulus in yz & ZX direction (Mpa)	2500
7	Poision ratio in X direction	0.27
8	Poision ratio in Y & Z direction	0.06
9	Density (Kg/mm^3)	0.000002

T S Manjunatha1 [4]

describe manufacturing and experimentation of composite helical springs for automotive suspension**.** This paper explains use of fiber reinforced plastic in springs. Three different types of helical compression springs were manufactured using glass fiber, carbon fiber and glass/carbon fiber in +45 degree orientation. The helical

compression spring rate of the carbon fiber spring is found to be 24% more than the glass fiber spring and 10% more than the glass/carbon fiber spring. The weight of the composite spring is almost 70% less than that of the steel spring. Stresses acting on the composite helical compression springs were less compared to helical compression steel spring.

Pinjarla.Poornamohan[5]

described design and analysis of a shock absorber. Analysis performed by varying spring material Spring Steel and Beryllium Copper. The analyzed stress values are less than their respective yield stress values. So design safe. Analysis using material spring steel for spring is best**.**

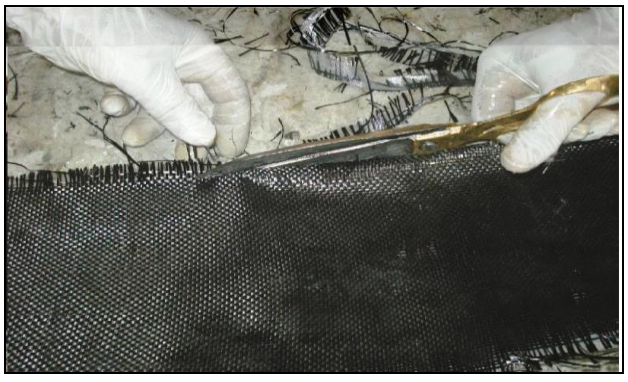

Figure 1 . Process of winding

The fiber tape after dipping in the epoxy resin is wound on the mandrel. This process of winding the tape on the mandrel is continued till the required thickness of spring is obtained on the mandrel. After the completion of winding, the shrink tape is wound on the mandrel as shown in Figure.

George E Dieter [6]

presented in the materia l selection and design data thoroghly . The bestchoice are high strength spring steel lying near the top end of the line and at the other end rubber, but certain other material suggested to GFRP(Now used in truck suspension spring), titanium alloy

Design requirement of spring Objective

1 maximum energy stored per unit volume

2 maximum energy stored per unit weight

3 maximum energy stored per unit cost.

Krishan k Chavla [7]

Composite materials, detail discussed about composite material around the world. There are possibilities in improvement that one can obtain by using composite material over conventional material. From the figure it's very clear that demand of light weight, high stiffness can achieved with help of composite material because they are very high strength high stiffness and low weight

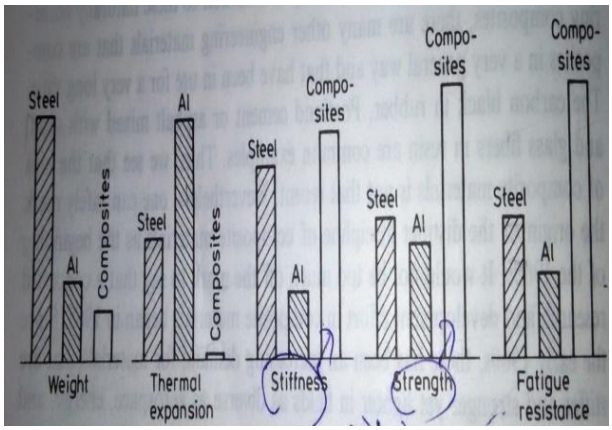

Figure 2: comparison of Composite material with conventional material

ANALYTICAL DESIGN OF HELICAL COMPRESSION SPRING

Table 3: Helical compression spring dimension

No.	Parameter	Dimension(mm)
1.	Wire Diameter Wd	7
2.	Outer Diameter OD	50
3.	Free length	229
4.	No. of Active Coil n_a	16
5.	Total no. Coil	18
6.	Spring Weight	.805 Kg

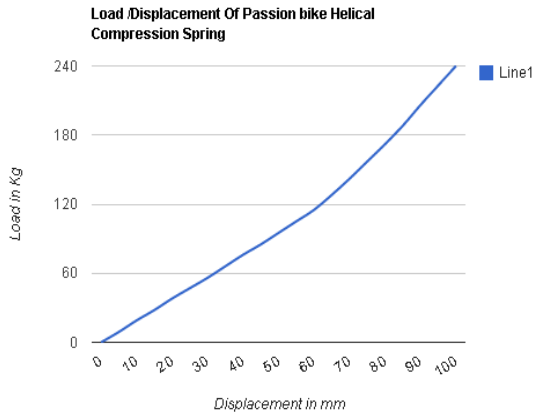

Figure 4.7 : Load/Displacement graph

FEM ANALYSIS

Finite element analysis (FEA) is use for stress, deformation analysis. The Complete procedure of analysis has been done using ANSYS workbench 14. To conduct finite element Analysis, the general process of FEA is divided into three main phases.

1 Preprocessor

- Type of analysis: Static Structural
- Geometric modal: in CREO
- Type of Element: hexa hedral
- Material properties spring steel and E glass Epoxy
- Meshing : Automatic
- Loading Conditions : vary the displacement

Boundary Conditions : spring involves the fixation of one of the revolute joint and applying displacement support at the other end of spring.

By applying displacement and measuring the force and stress at other end.
FEM analysis can be done two ways

1) Applying force

2) Applying displacement.

During ride, vehicle may fall in damaged road pot hole or on the bump. It provide displacement to the shock absorber and transmit it into force to the occupant .in this analysis approach to measure the force by giving displacement.

Table 4: Displacement condition

Sr. no	Displacement In mm
1	20
2	30
3	40

Applying this displacement condition in conventional Spring Steel material and Composite E glass Epoxy material shock absorber. And measure there performances.

1 Von –Mises Stress for Displacement in Spring Steel material
Shockabsorber

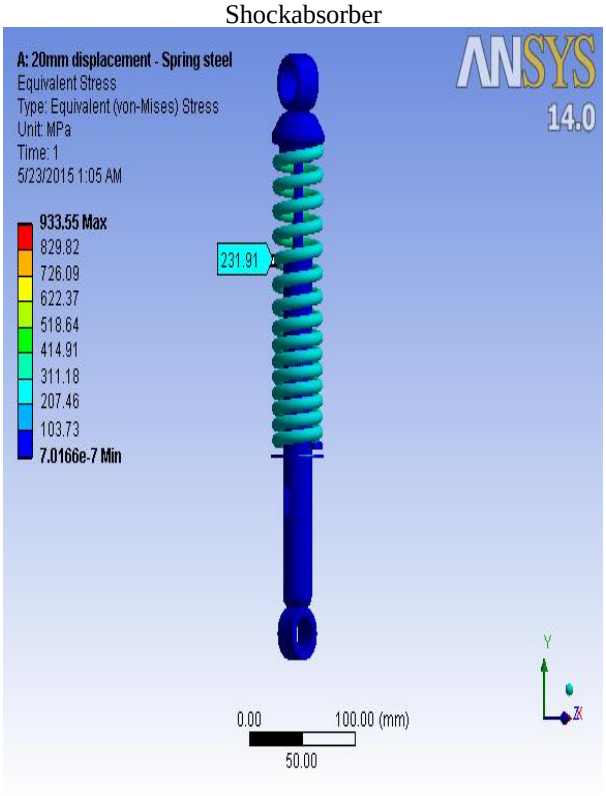

Figure 3: Von –Mises Stress for 20 mm Displacement in Spring Steel material Shock absorber

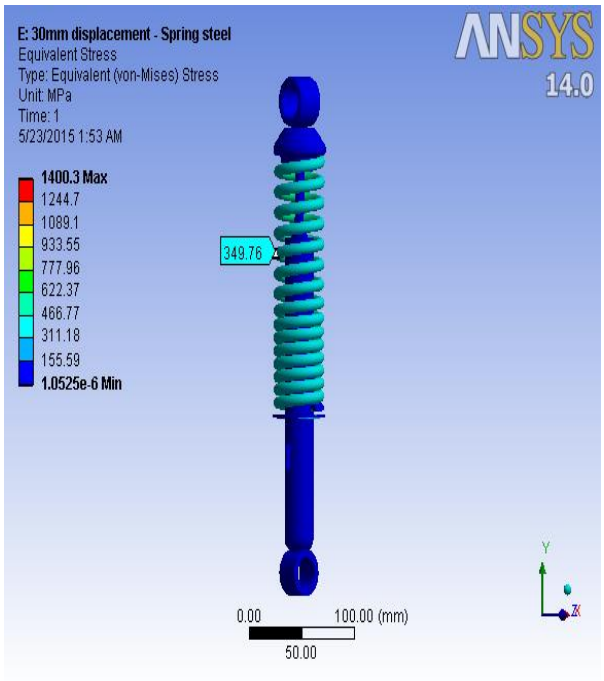

Figure 4: Von –Mises Stress for 30 mm Displacement in Spring Steel material Shock absorber

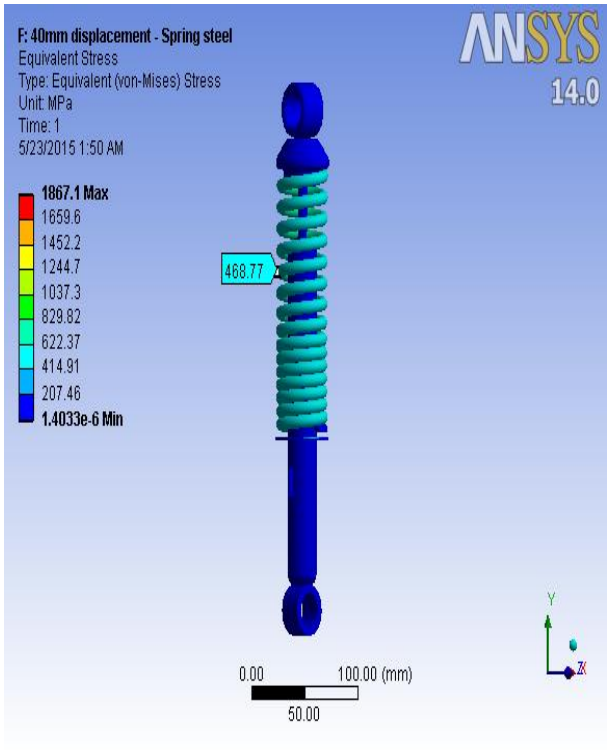

Figure 5 : Von –Mises Stress for 40 mm Displacement in Spring Steel material Shock absorber

Von –Mises Stress for Displacement in E glass epoxy material Shock absorber.

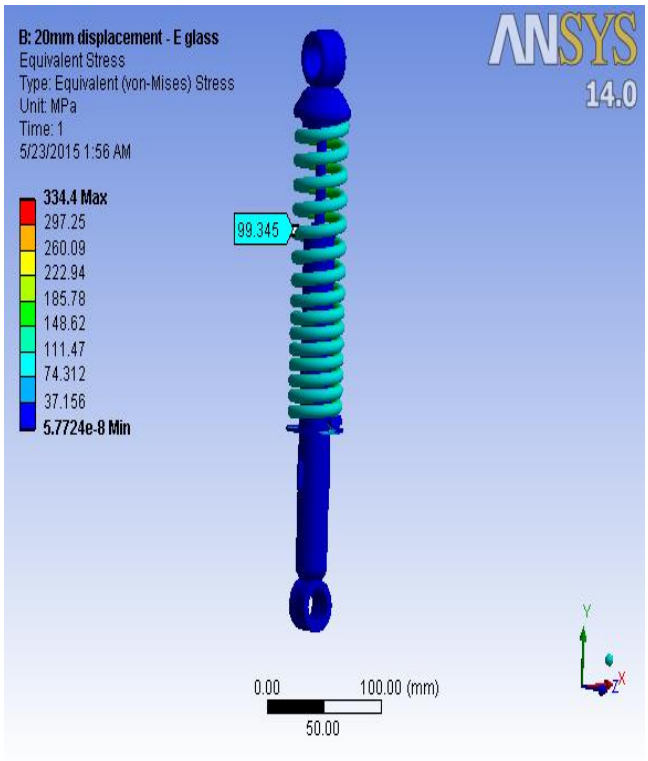

Figure 6: Von –Mises Stress for20mmDisplacement in E glass epoxy Shock absorber.

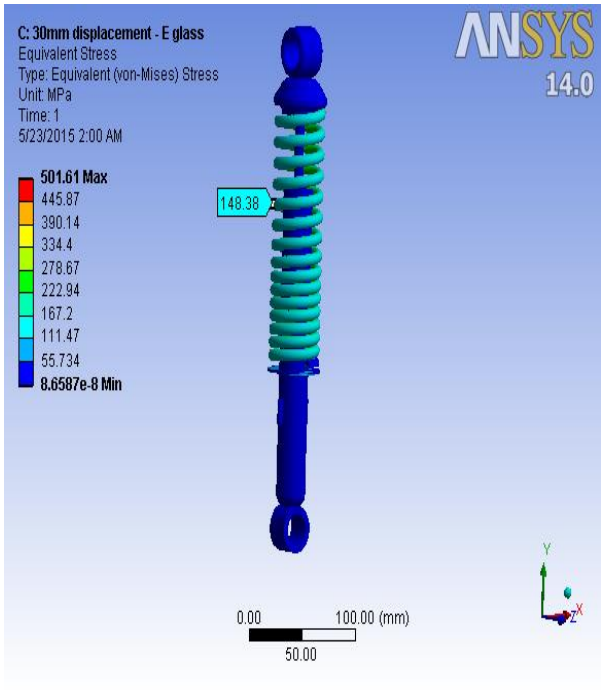

Figure 7: Von –Mises Stress for 30mm Displacement in E glass epoxy Shock absorber.

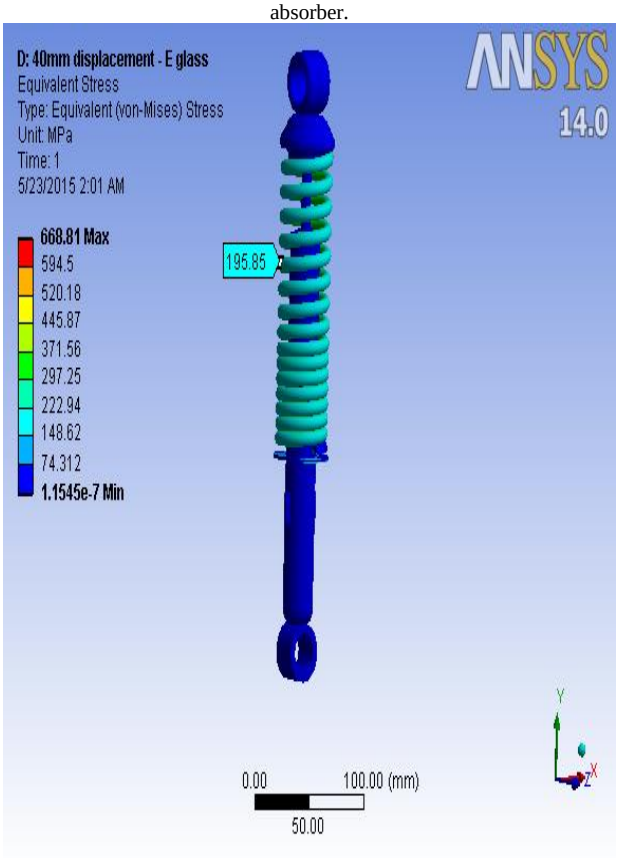

Figure 8: Von –Mises Stress for 40mm Displacement in E glass epoxy Shock absorber

Result

Von mises stress in spring steel material and E glass Epoxy material helical compression spring Shock absorber.

Table 5 : Displacement –Stress analysis

	Displacement	Maximum Stress developed in Shock absorber	
Sr. No	mm	Present Design (Spring Steel) MPa	Modified Design (E glass Epoxy) MPa
1	20	231.91	99.34
2	30	349.76	148.38
3	40	468.77	195.85

As shown in above analysis, Stress value is plotted in result tabular format. Stress developed in the composite E glass Epoxy design is comparatively lower than spring steel conventional model. So E glass Epoxy composite material helical compression spring shock absorber design are more safe compare to Conventional shock absorber.

CONCLUSION

we can measure the deformation and stress by applying load . and the reverse side approach is also utilized by applying displacement we can measure the stress developed at other end.E glass Epoxy material helical compression spring shock absorber ore shock so it will reduce transmitting force to the reduce the acceleration which is essential for improve drive comfort. E glass Epoxy Shock absorber having less stress produced than spring steel conventional model and all the stress developed are lower than yield strength . composite spring absorbs more shock than conventional shock absorber. Composite E glass Epoxy material Reduce the 34% weight of shock absorber. It will reduce the unsprung mass so it will reduce the acceleration which is essential for improve drive comfort.

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